Socio-Demographic Context of the AIDS Epidemic in a Rural Area in Tanzania with a Focus on People's Mobility and Marriage

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Socio-demographic context of the AIDS epidemic in a rural area in Tanzania with a focus on people's mobility and marriage

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With an estimated 71% of the estimated 34.3 million adults and children living with HIV, the AIDS epidemic in sub-Saharan Africa is much more severe than in any other continent in the world (Schwartlander et al., 2000). A range of socio-cultural, political and economic factors are thought to favor HIV transmission in many African societies to a much greater extent than elsewhere in the world (Cohen and Trussell, 1996; Caldwell, 1989). But also within sub-Saharan Africa large differentials in HIV prevalence have been observed between countries (UNAIDS, 2000), between regions of the same country, between urban and rural areas in the same region, and within rural areas (Carael, 1997; Wawer et al., 1991; Boerma et al., 1999). A wide range of factors ranging from socio-economic and demographic factors to sexual behavior patterns, male circumcision practices and the prevalence of incurable STIs have been held responsible for the uneven spread of HIV within the continent (Caldwell and Caldwell, 1993).

Studies in western societies have shown the key role of core groups in the epidemiology of sexually transmitted diseases (Thomas and Tucker, 1996). Recent studies in Asia have shows the importance of bridge populations, of which members have sex with both members of core groups and of the general population (Morris et al., 1996; Gorbach et al., 2000). There are also studies, mainly among sex workers, in sub-Saharan Africa that have pointed to the importance of core groups in the HIV and STI epidemics (Laga et al. 1994; Steen et al.; 2000, Moses et al., 1991). Yet, HIV prevalence in several sub-Saharan Africa countries has reached levels that suggest widespread occurrence of risk behaviors in the general adult population, as also shown in sexual behavior surveys (Cleland and Ferry, 1994). In this context it is less obvious whether it is relevant for research and intervention strategies to distinguish subpopulations and classify those into spread networks (characterized by higher rates of concurrent partnerships, by large numbers of sexual linkages throughout the subpopulation, and by some sexual contact with other subpopulations) and maintenance networks (located in subpopulations with relatively lower rates of sexual interaction), as proposed by Wasserheit and Aral (1996). They classify STI epidemics into four phases, starting with an early growth phase, followed by hyperendemic, decline and endemic phases. Intervention programs should adapt to the different phases. In early phases prevention efforts should include efforts to raise general public awareness of the 'new' STI and improved counseling, detection and treatment services, with concerted and additional efforts for spread networks. In the subsequent stages it is thought that prevention strategies should focus more on outreach and community-level behavioral interventions in hard-to-reach populations and less on general population interventions. Hitherto, research and interventions have primarily focused on raising knowledge and awareness in the general population, condom promotion to the general public, and control of sexually transmitted diseases in the general population or in specific high-risk groups or both. The targeted high risk groups – as representatives of the spread network - are most commonly female commercial sex workers, truck drivers and sometimes long-distance migrant laborers (Haour et al., 1999; Cohen and Trussell, 1996). Currently, the case is made for more emphasis on interventions focused on sub-populations, in part motivated by epidemiological considerations, but largely driven by resource limitations in proportion to the huge epidemic (Ainsworth and Teokul, 2000).

This paper describes the context of the AIDS epidemic in a small rural area in Tanzania, where a population of about 20,000 people has been followed since 1994. The current analysis includes the period 1994-1998 and focuses on population characteristics rather than individual risk factors. Special attention is given to people's mobility and marriage patterns and how these relate to sexual behavior and HIV infection at the community level. It is shown that mobility and marriage are critical contextual factors in this population, and sexual mixing is dynamic and diffuse. It does not appear to be possible to identify and target spread or maintenance networks. In terms of interventions, this does not mean that focusing interventions is not possible. However, an area-

based strategy seems more feasible and more suitable than an approach aimed at high-risk networks.

Data sources

Kisesa ward is located in Mwanza Region in northwest Tanzania, about 20 km east of the regional capital Mwanza, along the main road to Kenya (Figure 1). It includes six villages with a trading center along the main road, which have been grouped into trading center, peri-trading center and agricultural rural villages for the purpose of this study (Boerma et al., 1999). A community cohort study was initiated in 1994 and this study includes data from the following sources:

- *Demographic surveillance system*: collects basic demographic information. Since 1994 household visits have been made every 4-5 months and by late 1998 ten rounds had been completed (Urassa et al., forthcoming; Boerma et al., 1999). All households are visited each round and information is collected on residence and survival status of all household members, on pregnancy of women of reproductive ages and on new arrivals (migrants, newborns). A new person was only listed as a household member if the household respondent had indicated that this person was intending to stay in the household. If the person had left the household by the next round he or she was not considered a household member. For each resident it was asked whether or not this person had slept in the household the night preceding the visit.
- *Epidemiological and behavioral surveys of adults*: during 1994-1995 and again two years later a survey of all adults 15-44 and 15-46 respectively was carried out. In total, 5,820 and 6,413 respondents participated in the first and second survey respectively (response rates 78% and 80%). The surveys included a structured interview on background characteristics, AIDS knowledge and attitude, sexual behavior, STI treatment, etc., and collection of a blood sample for HIV antibody and TPHA testing in the first survey and HIV only in the second survey (Boerma et al., 1999).
- *Sexual mixing module*: in the second survey a special module was used to obtain information on all marital partnerships and on the last five non-marital sexual partnerships in the last year. This module included information on the age, marital status and place of residence of the sexual partner. The 3,684 respondents of the sexual network module (1,651 men and 2,033 women) reported 2,439 non-marital partnerships in the last year. Reports were obtained from a total of 1,130 male and 803 female spouses, and 554 male and 1,990 female non-marital partners, with whom respondents had sexual relations in the last year (Nnko et al., 2000).
- *Travelers' survey*: in 1997 the field workers counted vehicles and interviewed travelers during a single week on all primary and secondary roads in the area. These are the main connecting roads in the ward.
- *Bar and sex work survey*: qualitative methods were used to collect data on mobility, bars, and commercial sex. Local informants listed all bars, including traditional brew selling points called *pombe* shops. Field workers and local informants listed all bar and *pombe* shop workers and women who tend to frequent such places and are willing to have sex for a small payment or gift.
- *STI treatment services*: data on health service utilization by STI patients were derived from routine records of all health facilities in the study area. All traditional healers in the study area were also interviewed about STI treatment and other conditions (Pool et al., 2000).

Study setting

The total population of Kisesa ward was 19,458 in 1994 and grew with 2.5% per year to 21,774 by the 10th demographic round in late 1998. The latter included 12,073 people living in the rural villages, 4,085 in the peri-trading center area and 5,616 in the trading center. Population growth was faster in the peri-trading center area and trading center (3.7 and 3.4% per year respectively) than in the rural villages (1.7%). Nearly half of the population is under 15 (46%) and large cohorts of young people will be moving into the reproductive age span in the coming years. For example, while 10.2% of the population are aged 15-19, 13.2% are age 10-14.

Data from the survey in 1994-95 are used to describe a few basic features of the Kisesa adult population 15-44. The predominant ethnic group were Sukuma (95% of 5,751 respondents). Christianity was the most common religion (74%), followed by traditional religion (23%) and Islam (3%). Thirteen percent of men and 29% of women were illiterate, and only 5% of men and 2% of women had secondary school or higher. Farming was the main source of income, while petty trade of agricultural products (milk, tomatoes, maize, rice, fish, etc.) was common. No data were collected on household income in monetary terms. In 1994, 38% of households owned a radio, 39% had at least one bicycle, and 2% had a motorized vehicle. Annual income in this rural population with recurrent droughts and shortage of off-farm employment is likely to be in the same order of magnitude or somewhat lower than the Tanzanian GDP per capita which was estimated about $120 in 1995 (World Bank, 1995).

Traditionally, the Sukuma do not circumcise, although recent data indicate a popularization of the practice of male circumcision, as about 21% of Sukuma men 15-44 in Kisesa ward reported themselves as circumcised (Nnko et al., 2000). Postpartum sexual abstinence is fairly short with about two-thirds of women having resumed sexual intercourse at six months after giving birth.

Prevention efforts

The HIV/STI prevention activities of the Tanzania National AIDS Control Programme (NACP) have primarily focused on condom promotion and distribution (initially through free condoms distributed to health facilities, later also through social marketing), raising awareness and knowledge of the AIDS epidemic, postponement of first sex in adolescence and health education to the general public to reduce multiple partnerships. The Tanzania-Netherlands project to support AIDS control in Mwanza region (TANESA) collaborates with its local partners (Regional Medical Office, National Institute for Medical Research, Bugando Medical Centre) to develop new interventions and support the implementation of national programs. In the context of the Kisesa community study the aim was not to develop and evaluate a large and well-defined intervention, but to focus only on supporting the regular AIDS activities of the district through the district authorities, and to provide other non-AIDS related community support to compensate for the study participation. The district budget for AIDS control activities was very small, barely sufficient to pay one Ministry of Health staff member with a motorbike to supply condoms and provide AIDS education at government health facilities in a district of more than 300,000 people, including an estimated 10,000 infected adults. Non-government organizations and the private sector have a limited coverage in the district and Kisesa ward. The main HIV/STI control activity was the introduction of the syndromic approach for the treatment of STIs, supported by AMREF, a non-government organization and the European Commission, following the successful intervention trial in Mwanza Region (Grosskurth et al., 1995).

Until 1996 the main interventions were increased availability of condoms through mainly the health facilities and health education of the general public. Towards the end of 1996 several

community interventions were introduced in Kisesa to promote safer sexual behavior. These interventions covered Kisesa trading center and one rural village and included community mapping of high-risk places, establishment of village AIDS committees, community campaigns against AIDS, formulation of village by-laws to reduce high-risk sexual behavior and school-based AIDS education. Towards the end of the study period social marketing condoms were introduced in shops. Voluntary HIV testing and counseling was offered during the 1996-97 survey but very few people made use of this service (less than 1% of the survey participants).

Virtually all respondents had heard of AIDS (99.5% in 1996/97), and knew HIV could be transmitted by sex (97%). However, only 68% said a healthy person could have HIV, and 76% had heard of condoms.

There were three government dispensaries (a fourth was opened in 1996), one private health facility and 38 traditional healers in Kisesa ward (in 1994). As part of the regional effort to strengthen STI services, syndromic treatment, including regular supervision and improved drug supplies for STI treatment, became available in one government dispensary in late 1994, and in two other dispensaries mid 1996. From the time of the introduction of the syndromic approach data on the numbers of STI clients are available.

Marriage, mobility and the risk of infection

As HIV and other STIs affect various subpopulations, the extent and spread are directly or indirectly affected by a wide range of underlying factors that may be associated with each other (Wasserheit and Aral, 1996). In demographic research, proximate determinant models have been frequently used to study the determinants of fertility (Bongaarts, 1978) and the determinants of child mortality (Mosley and Chen, 1984). The key feature of these models is the identification of a set of proximate determinants through which social, economic and cultural factors affect fertility or child mortality, forming the hinge between the social and biological systems. These proximate determinants are behavioral and biological in nature: they can be changed by social change or interventions, and if they change there is a direct biological effect on fertility or on child health and mortality. In case of HIV/AIDS the proximate determinants can be defined as the components of the basic reproduction rate of infection, which is determined by the rate of sex partner change, the risk of transmission per sexual act and the duration of infectiousness (May and Anderson, 1987). Underlying demographic, socio-economic and socio-cultural factors must operate through these proximate determinants to affect the risk of HIV infection. In the African context marriage patterns and population mobility are two very important underlying factors that affect the proximate determinants, especially the rate of sexual interaction between infected and susceptible people.

Marriage

Bledsoe and Pison (1997) have emphasized that marriage in the African context should be viewed as a process and that it may not be clear when a woman is married or not. Important features of contemporary marriage systems in sub-Saharan Africa are declining levels of polygyny, increasing levels of non-customary marriage and higher rates of marital dissolution (Carael, 1997; Bledsoe and Pison, 1997; Caldwell et al., 1989). Such changes are more common in urban areas. Typically, there are substantial age differences between marital partners in many populations and age at first marriage among women is often well below 20. In a context of permissiveness toward premarital sexual activity (Caldwell et al., 1989), this is likely to influence pre-marital partner selection and enhance age mixing. If premarital sexual behavior involves partnerships between young women and older men, this may introduce premarital infections at an early age. Indeed

very high rates of HIV infection among teenage women have been observed (Zaba et al., 2000) but not among teenage men and there is considerable variation between societies. High rates of divorce or separation and re-marriage may also affect partnership formation patterns and facilitate higher levels of partner turnover and concurrent partnerships in the population. High levels of extra-marital partnerships indicate high levels of concurrent partnerships as well.

Table 1 summarizes selected indicators of current and past marital behavior among respondents in the 1996-97 survey. The median age at first marriage for women was 19 and for men 23 and 5% of men and 15% of women were in a polygynous union. Virtually all men and women in a monogamous union were living in the same household. Among women in a polygynous union, 92.5% were cohabiting with their husbands.

Divorce and separation were common. Five percent of men and 10% of women were divorced or separated at the time of interview. Almost half of ever-married men and one-third of ever-married women had divorced at least once. As current status data indicate much lower divorce rates, re-marriage is likely to be very common and fairly soon after divorce. Men and women who were divorced at the time of the second survey were asked for the reason of the break-up of their most recent marriage. Among 118 male respondents the most common reason was unfaithfulness of their partner (55% of men said so), followed at a distance by lack of love (16%), infertility (6%), alcoholism of the wife (6%) and no payment of bride price (5%). Among 314 female respondents alcoholism of the husband (38%), lack of love (31%), unfaithfulness (27%) and violence (24%) were the most common reasons for divorce, followed by non-payment of bride price (7%) and infertility (3%).

The sexual network module collected additional information about current marital partnerships. An informal marital relationship ('*mapatano*', defined as a cohabitation which was not preceded by a traditional, government or church wedding) was reported by 25% of men and 43% of women. In addition, for more than 40% of marital relationships it was reported that the bride price had not been paid in full, mostly nothing had been paid at all. This mostly involved informal cohabiting relationships, but could also pertain to traditional or church marriages.

Mobility

Population mobility is high in much of Africa and may also enhance the rate of partner change and the introduction of new infections into less mobile populations (Caldwell et al. 1997; Quinn, 1994; Hunt, 1989). This may involve mobility during crises and emergency situations, but much larger populations are involved in permanent or circular migration to urban areas (Lurie et al., 1997; Hunt, 1989) or short-term mobility within or between urban and rural areas. Labor migration is a prime reason for permanent migration and for seasonal mobility leading to prolonged separation of partners and families. Initiation and dissolution of marriage (or less formal cohabitation arrangements) are also key reasons for migration. Studies in Senegal (Pison et al., 1993) and Uganda (Nunn et al., 1995) have shown that migration is an independent individual risk factor for the acquisition of HIV irrespective of origin or destination. Other studies have suggested that elevated levels of HIV prevalence can be observed in fairly small settlements, such as trading centers, along main roads, where mobility is common (Wawer et al., 1991; Barongo et al., 1992; Boerma et al. 1999).

According to the demographic surveillance system in Kisesa, a person aged 15 and over was considered a member of a household if he or she had stayed at least two rounds in a household and the head of the household indicated that this member was intending to stay. Migration rates were assessed by looking at the presence in the last demographic round (round 10, after 4 years)

among persons 15-59 who had been present in the first two demographic rounds. Overall, 10% of men and 12% of women moved each year during the study period (Table 2). In the trading center migration rates were highest and there was no male-female difference as observed in the rural villages. Figure 2 examines annual migration rates by age group. Female migration rates are higher because of very high migration rates among women under 25. Male and female migration rates are identical at ages 25 and over. In the trading center male migration rates peak at 25-29 (18% per year).

A large proportion of migration took place within the same village: 40% of men and 39% of women moved within the same village. The reasons for moving were collected but data were incomplete. Among those female migrants 15-49 for whom a clear reason was given marriage or divorce/separation was the most important reasons for permanently leaving a household: 25% did so because of marriage and 12% because of divorce/separation. This marriage/divorce ratio suggests high marital dissolution rates. As women often move into the new husband's household, marriage or divorce was less frequently a reason for moving among men (11%).

Short-term mobility was assessed using data from the demographic surveillance system and the travelers' survey. In each demographic round, data were collected on whether or not each resident had slept in the household the night before: 14% of men 15-59 and 11% of women 15-59 had reportedly not slept in the household the night before. Men were more commonly absent at all ages, and increasingly at older ages, except at 15-19 (Figure 3).

Field workers counted and interviewed all travelers on seven main 'checkpoints' within the study area during one day. Four checkpoints were along the main road that cuts through the study area. Bus travelers were only counted if the bus stopped and the passengers got off the bus in Kisesa. Overall, 4,798 travelers were interviewed and 76% of those were male. A small proportion was under 15 (7%), 41% 15-29 and 52% were 30 or older. More than one-third traveled alone (38%), 55% were two or three persons and 7% were four or more persons. The predominant mode of transportation was bicycle (65%), followed by walking (22%), car (8%) and bus (6%).

The checkpoint at the trading center had the largest volume and many (27% of 1,306 travelers) were on the way to Mwanza town. At the rural checkpoints very few travelers were heading for Mwanza town, but a large proportion were on the way to the trading center. About two-thirds of the travelers said they intended to return the same day, with little variation by destination. Overall, a remarkably high proportion of travelers said they did not know when they would return (29%). This may be because they indeed did not know, or because they did not want the interviewer to know.

The main purpose of the journey differed between travelers to town or trading center and travelers to the rural villages. Buying or selling, of mostly agricultural products, was the main reason among 60% and 68% of those going to town or the trading center respectively, compared to 37% among travelers between the rural villages. Among the latter, visiting relatives was also a common reason for travel (34%), which was mentioned by 13% and 16% of those with a town or trading center as a destination, respectively. Ceremonies (marriage, burial, etc.) were mentioned as the main reason for travel to the rural villages by 11% of respondents.

Sexual behavior

Abstinence, multiple partners and condoms

Selected indicators of sexual behavior based on the 1996-97 survey are shown in Table 3. The age at first sex was computed using a survival analysis based on current status (ever had sex) and recall data. Among respondents under the age of 25, the median age at first sex was about 16 for women and 17 for men in both surveys. Most never-married men and women were involved in sexual relationships.

Multiple partnerships were frequently reported. For instance, during the second survey 9% of men reported more than two partners in the last month and 29% more than two partners in the last year. Only 0.5% reported 12 or more partners in the last year. Almost half of the married men reported an extra-marital partner in the last year. Less than 2% of women reported two more partners in the last month or three or more partners in the last year. There was little evidence of change in the reporting of the frequency of multiple partnerships by men between the two surveys (data not shown).

Condom use was low. In 1996-97 85% of men and 69% of women said they had ever heard of condoms and 18% of men and 4% of women had ever used a condom. Condom use within marriage was negligible, and with regular non-cohabiting partners or with casual partners below 10%. For example, 8% of men reported that they always used a condom during casual sex, and an additional 17% sometimes used a condom. Among women the corresponding figures were 7% and 6% for always and sometimes respectively.

Sexual mixing patterns

Additional data on sexual mixing and characteristics of partnerships were collected in the sexual mixing module which was administered during the 1996-97 survey. The main results include (Nnko et al., 2000):

- Forty-two percent of partnerships reported by men and 13% of those reported by women lasted less than one month.
- Men are overall about 7 years older than their wives, and about 5-6 years older than their non-marital sexual partners. Girls under 20 reported sexual partners who were on average 5.3 years older than themselves; 9% had a non-marital partner aged 30 and over, 20% had a spouse aged 30 and older. Older men (30 and over) tended to have non-marital partners who were younger than their wives.
- There is limited mixing between the rural villages and the trading center, or between the ward as a whole and the nearby regional capital. Almost three quarters of the non-marital partnerships in the rural areas are within the same area. Nearly 90% of the partnerships that were reported by men living in the rural areas are with women from the same or other rural villages; 83% of partnerships reported by rural women are with partners from within the rural area.
- Women report a slightly higher proportion (13%) of non-marital partners from outside the study area (Mwanza town or far away) than men (9%). Higher proportions (7%) of women who live in the rural villages report having lovers in the trading center at Kisesa than are reported by men who live in the rural villages (2%), but women are less likely than men to report partners from other villages. Two percent of men and 8% of women respondents report sexual contacts with people from Mwanza town.

- ▪ Nearly all extra-marital partnerships reported by men involved unmarried women, single or divorced (96%).
- ▪ Using the level of education as an indicator of social class, mixing between men from higher social classes with women from lower social classes was fairly common, but not the other way around.
- ▪ In an average month during the six-month period preceding the interview 16% of unmarried men, 21% of married men, and 2% of women (married or not) were involved in overlapping partnerships. The interval between ending one partnership and commencing a new one was short in most instances. Most partnership endings involved single men. Among 937 non-marital partnership endings reported by single men, 27% had another non-marital partnership ongoing, 9% started a new partnership in the same month in which the previous partnership ended, and 28% started a new partnership with at least a gap of one month.

Commercial sex

The male field workers listed all women available for sex in exchange for money, using key informants. In total, 365 women were listed. Four groups were distinguished by the informants and field workers: bar workers (42% of all women), women who visit bars and solicit sex (30%), women who live alone and can provide sex in their house (*'guesti bubu'*) (20%) and women who sell sex only if they badly need money (8%). None of these women were labeled as commercial sex workers. As was shown in a study of female bar workers elsewhere in the district – and supported by intervention work with women working in bars in nearby Mwanza town – there is no clear distinction between commercial and non-commercial sex. Some have a regular partner and an occasional casual partner, while others have larger numbers of casual contacts (Mgalla and Pool, 1997). Mobility among bar workers was high. No detailed data were collected on the price of sex, but qualitative data suggest that the price of sexual intercourse with a 'sex worker' was below $1 in most instances (official minimum wage for a day's work is about $1.50). For Kisesa, the number of women listed as available for sex for money corresponds with 1 per 14 men aged 15 and over.

HIV/STI epidemiology

HIV by age and sex

HIV prevalence among men and women 15-44 was 5.8% in 1994/95 and 6.6% in 1996/96, while HIV incidence in the inter-survey period was 0.7 and 0.8 per 100 person years among men and women respectively (Boerma et al., 1999). Figures 4 presents the observed HIV prevalence in both surveys and the 'expected HIV prevalence', derived from HIV incidence rates, by age for men and women separately (in two-year and, at older ages, three-year age groups -sample size exceeding 125 in all age groups). The 'expected HIV prevalence' represents hypothetical prevalence if a 15-year-old were exposed to the current incidence rates until age x and was calculated from the HIV incidence rates[1]. For both sexes the shapes of prevalence curves are

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[1] The HIV incidence rate can be treated analogously to the central death rate, $_nM_x$, in a life table, as it is a ratio of events to persons years at risk. In life table terms, the age pattern of stable prevalence associated with a given regime of incidence rates is given by the complement of the proportionate person years function $((1-_nL_x)/n)$. Obtaining the person years $_nL_x$ function from the central rate, $_nM_x$, is a standard straightforward calculation, provided we can make some simplifying assumptions about the linearity of change with age in the proportion of susceptibles, l_x, in the population - within the narrow 2 and 3 year age intervals considered here such an assumption is justified.

similar, with a small increase in the 1996-97 survey. The expected HIV prevalence initially lies close to the prevalence curves. Observed HIV prevalence and expected prevalence curves diverge from age 26-27 for women and age 30-32 for men, which is likely to be associated both with increased HIV-associated mortality and possibly discrepancy between current and past incidence among older cohorts. For women the curves show an almost linear increase during the first 10-15 years after the initiation of sexual intercourse (15-17 years of age). The increase among women has a steeper slope than among men. HIV prevalence among women exceeds 5 percent at about 20 and 10 percent at 25 years of age. Male HIV prevalence reaches these levels at an age 5-6 years older.

HIV by residence and mobility

The surveys revealed striking differences in HIV prevalence and incidence within the small geographic area. HIV prevalence in the trading center was twice that in the area surrounding the trading center (within 2 km) and three to four times higher than that in the rural villages (within 8 km of the trading center) (Boerma et al., 1999). Analysis of individual risk factors of HIV infection showed that the large impact of the community factors remained after controlling for multiple individual demographic, socioeconomic, biological and behavioral variables (Bloom et al., 2000). The main community characteristics that affected the risk of HIV included level of economic and social activity, numbers of female bar workers in the community, mobility of the population, and proximity to town. There were also some differences in sexual behavior between communities, but these were fairly modest and did not explain the effect of community on the risk of HIV.

Other studies have shown an association between HIV prevalence and individual mobility (Nunn et al., 1995). Also in Kisesa those who moved into the ward had higher prevalence compared to those who had lived in the ward all their lives, although the differences were fairly small and became smaller when controlling for other variables (Bloom et al., 2000). The lower participation rates in a survey of more mobile individuals is however an important bias for the individual level analysis. The main reason for non-participation in the survey was travel, short-term or long-term (Boerma et al., 1999). Current marital status (being divorced or separated) and a history of divorce were strongly associated with the risk of HIV, both in analysis of prevalence and incidence.

Other sexually transmitted infections

Serological data on other STIs were only available from the first survey in 1994-95, when whole blood was collected and tested with a TPHA and VDRL test in the laboratory. Overall, 15.5% 2,455 men had a positive TPHA test, including 11.3% who also had a positive VDRL test which is taken as evidence of recent or current syphilis. Among 2,641 women the corresponding figures were 20.5% with a positive TPHA test and 15.8% with a positive TPHA and VDRL test. Positive reactions were least common among men and women 15-19 (1.8 and 8.1% respectively), and there was little variation from age 20 onward.

Self-reported data were collected for genital discharge and genital ulcer in the 12 months preceding the survey. In 1996-97, 10.2% of men and 6.3% of women reported a genital discharge in the last year, while 10.8% of men and 4.6% of women reported a genital ulcer in the last year. Among men and women with a self-reported genital discharge or ulcer 46.1% and 38.9% respectively had visited a health facility for treatment. The second most popular source of treatment was traditional healers of which there were 37 in the study area in 1995 (used by 23.1% and 22.8% of men and women respectively). During the interviews with traditional healers

however only few said they treated large numbers of patients and Pool et al. (2000) argue that the traditional healers play a relatively limited role in the treatment of STIs in this area.

The three dispensaries in Kisesa ward started to provide STI services using the syndromic approach in 1994 (one dispensary in the trading center) and in 1996 (two rural dispensaries). These clinics saw 393 STI patients in 1996 and 380 in 1997 and 59% were women. The leading diagnoses for 1994-97 were genital discharge syndrome (36.4% of all 1141 diagnoses), genital ulcer syndrome (24.7%) and pelvic inflammatory disease (21.8%). Since there were approximately 8,500 adults 15-44 living in Kisesa in 1996, the clinic data suggest an incidence less than 2% for genital discharge and for genital ulcers. As such, there is considerable discrepancy between the incidence of STIs based on self-reported and on clinic data which may be due to non-utilization of modern health services, use of services outside the study area, and poor quality of self-reported data.

There are no reasons to assume that the pattern of STIs in Kisesa is different from other settlements in Mwanza Region. Studies in similar populations have shown that herpes simplex virus (HSV-2) is common, with 20% of men and 50% of women 15-29 having antibodies (Obasi et al., 1999), although HSV-2 was responsible for less than 10% of genital ulcers in clinical studies (Grosskurth et al., 2000). Similarly high rates of sero-syphilis have also been observed, while – mostly asymptomatic - gonorrhea and chlamydia infection were found in 2-3% of the adult male population (Grosskurth et al., 1995). In a population-based survey of men, 2.2% had gonorrhea and 0.7% chlamydia infection, often asymptomatic (Grosskurth et al., 1996). In antenatal clinics trichomonas vaginalis infection was most common (27% of 964 women), followed by active syphilis (10%), chlamydia trachomatis (6.6%) and gonorrhea (2.1%) (Mayaud et al., 1995).

Discussion

This analysis focused on population characteristics of a small poor semi-urban and rural population in northwest Tanzania, and how these may directly and indirectly affect the epidemiology of HIV and other STIs. The overwhelming majority of the households live in poverty conditions, which may be an important factor contributing to the high levels of short-term mobility and migration within and outside the study area. The demographic surveillance system showed high rates of annual migration and high proportions of household members not spending the night in the household. This is high in all age groups, but especially among women under 25. Males, however, appear to be involved in the bulk of short-distance trading, mainly on bicycles, and from rural villages to trading center and from trading center to town.

It also appears that socio-economic and socio-cultural changes are affecting marriage systems. The study presents evidence of high levels of marital instability. One in ten women were divorced or separated at the time of the survey, large proportions of men and women had a divorce in their marital history, and divorce was a common reason for changing residence. The traditional system of marriage support may have weakened, as evidenced by the large proportion of less formal marriages and incomplete wealth transfer in association with marriage. More in-depth research on marriage patterns is urgently needed.

Sexual behavior data indicate that premarital sex and multiple partnerships are common, while condom use was low. Most boys and girls were sexually active by age 16-17. The sexual partners of teenage girls were on average five (non-marital) to seven (marital partner) years older and a significant proportion of teenage girls had a sexual partner aged 30 or over. There are recurrent

periods of different levels of risk related to marriage, and short- and long-term mobility is high. Extensive sexual mixing occurs by place and age and across social boundaries. The moderately high to high levels of migration, marital instability, adolescent sexual activity, extensive sexual mixing, and sexually transmitted infections in the Kisesa population are all factors that could lead to high levels of HIV incidence. Yet, HIV prevalence and incidence data for 1994-97 suggest that, even though the epidemic has not reached its peak, prevalence levels well over 10% in the whole Kisesa ward adult population are not likely. Most notably, HIV prevalence among young women (and young men) was relatively low and slowly increasing by age in Kisesa, compared to rural prevalence studies elsewhere in Tanzania, Uganda, Zambia and urban populations (Shao et al., 1995; Mulder et al., 1995; Fylkesnes et al., 1998; Fontanet et al., 1998; Mbizvo et al., 1996). Our study provides little evidence to show that adolescent sexual behavior in Kisesa differs from other places with much higher incidence under 20, neither in terms of onset of sexual intercourse nor in terms of mixing with older age groups, but data are limited.

The spatial analysis of sexual mixing patterns of non-marital partnerships showed that there is a limited level of mixing between the rural population and the trading center (and beyond). Nearly eight out of ten partnerships in the trading center and in the rural villages are within the same location. Less than 10% of the partnerships are between the rural villages and trading center. It is difficult to assess whether this level of spatial mixing is sufficient or not to enhance the spread of HIV from the trading center to the rural areas and level the difference. In part, it depends on further mixing of partners within the rural villages. If those who have partnerships with the higher HIV prevalence trading center (or the regional capital) have multiple partnerships within the study area, rapid HIV spread is possible. There was only limited evidence that this may be the case.

During the next years large numbers of new infections may occur in the Kisesa population, if only because of the larger numbers of newly sexually active young men and women and the prospective sexual partnerships with a large number of infected men and women. Further spread of HIV from the trading center to the rural villages is also possible, as there are frequent formal (marital) and informal contacts within this small rural area. Kisesa also hosts many travelers from outside the area, notably from Mwanza town and other rural areas, and sexual mixing may easily introduce new (primary) infections into the population.

Current evidence on the course of the AIDS epidemic in much of sub-Saharan Africa leaves little room for priority setting according to the phase of the epidemic, which is hyperendemic in the Kisesa population as in many other populations in sub-Saharan Africa, using the terminology proposed by Wasserheit and Aral (1996). The size of the epidemic and consequent human suffering are unprecedented in recent African history, and at first impression a full-blown multi-intervention strategy aimed at all population groups in the society seems justified with relatively more emphasis on the most cost-effective interventions. Reality in most countries with generalized epidemics dictates a much more modest agenda than is desirable.

In a context of a perennial lack of resources and poor health service infrastructure, multiple other illnesses compete for the scarce resources. Even though it does not seem to be possible to clearly distinguish between spread and maintenance networks (Wasserheit and Aral, 1996), or to single out those with the riskiest behavior (Ainsworth and Teokul, 2000), there is scope for a more focused and potentially more cost-effective approach to interventions. It appears that focusing on places such as the trading center, where more travelers come by and more women are engaged in commercial sex, HIV prevalence and incidence are considerably higher than in rural villages (Boerma et al., 1999; Bloom et al., 2000). Focusing interventions on geographic 'core' areas rather than on core groups was also considered the most effective and most feasible approach in a

study in the industrialized world (Blanchard et al., 1998). Such an approach could focus on places where people meet (new) sexual partners, as is done in the high transmission area approach (Weir et al., 2000) and if successful it is likely to have spill-over effects on the epidemic into neighboring areas. The interventions should include social marketing of condoms, especially in the bars, traditional brew shops and guest houses, general AIDS education in places where people meet sexual partners, improved STI services, and adolescent sexual health programs in schools. This high transmission area approach needs to be complemented with basic general population interventions, including increased condom access and, even though its cost-effectiveness has not yet been proven and many operational obstacles are anticipated, adolescent sexual health programs in schools.

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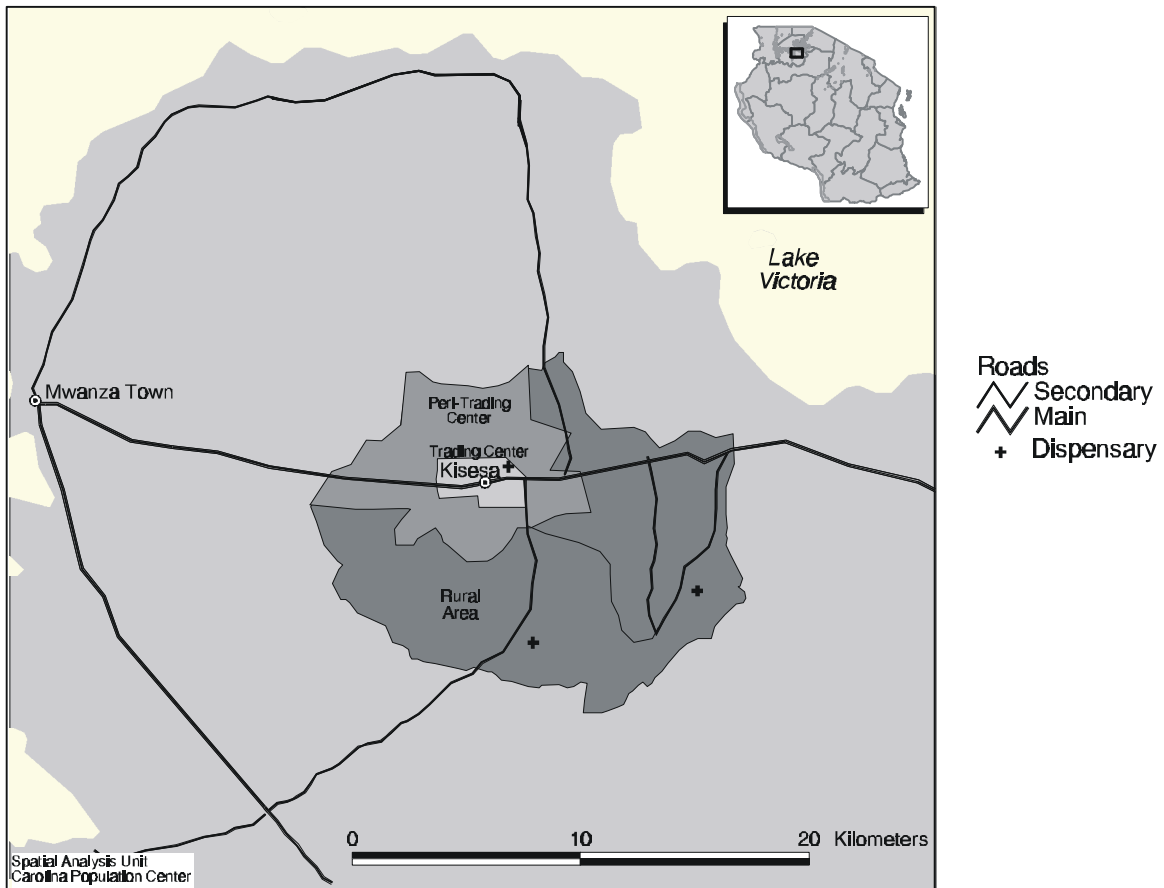
Figure 1
Map of Kisesa

Figure 2
Annual migration among men and women 15-59 years
by age in Kisesa, 1994-98
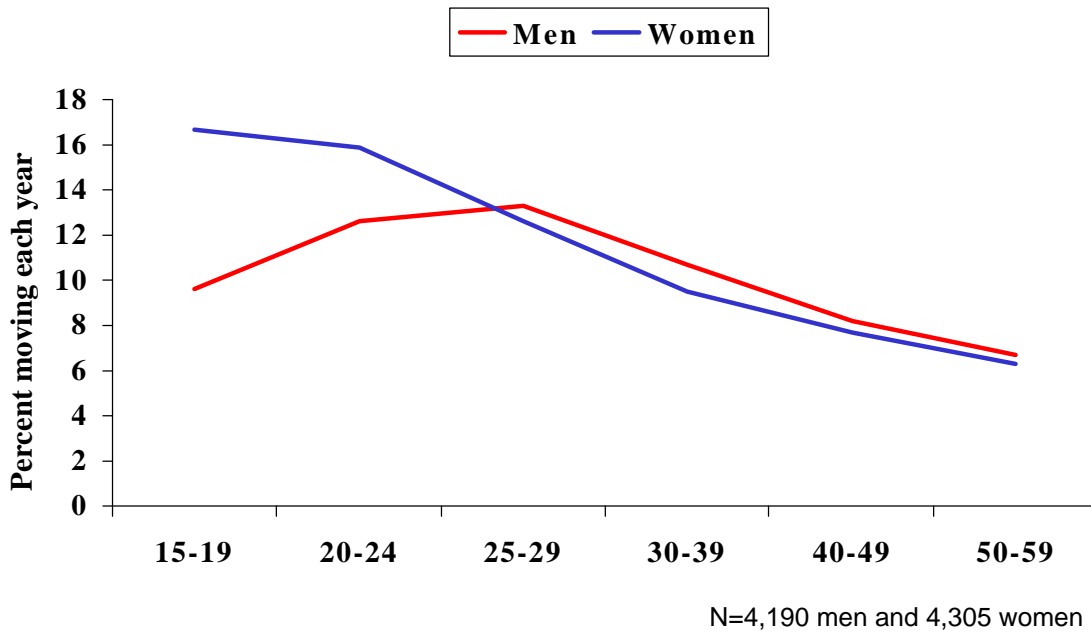

N=4,190 men and 4,305 women

Figure 3
Daily mobility: not sleeping in household on night before visit
in Kisesa, by age

Figure 4a
Observed and 'expected' HIV prevalence
among men, Kisesa 1994-97

The expected HIV prevalence is based on the incidence
rates in the period between the two surveys
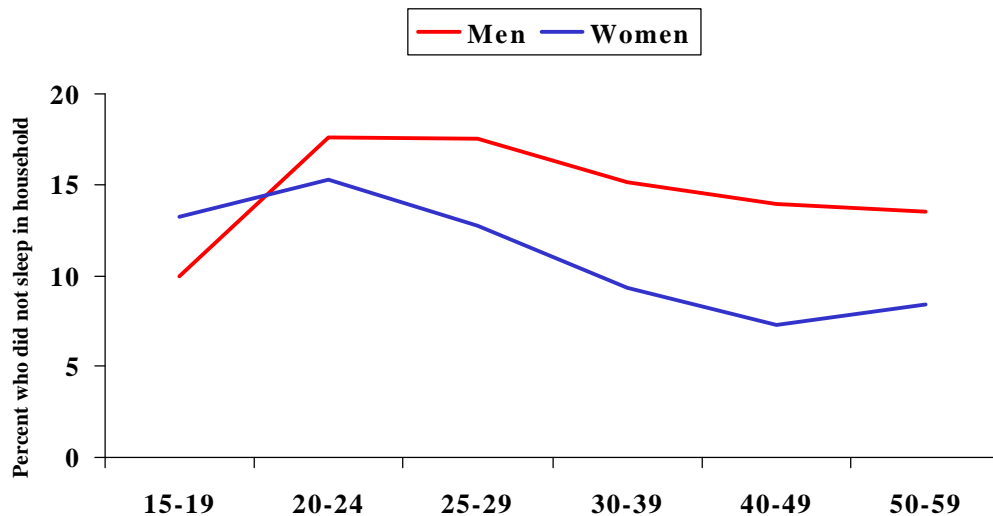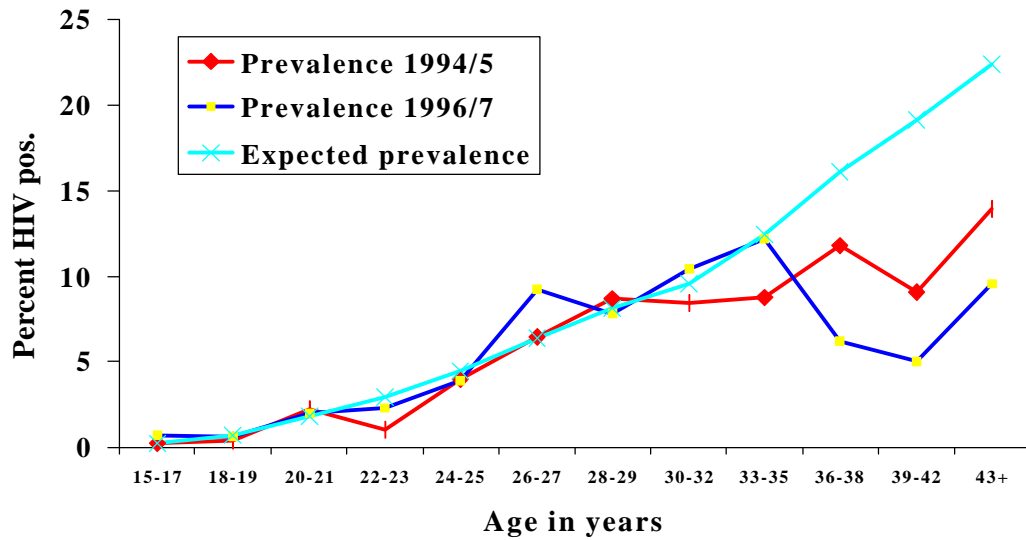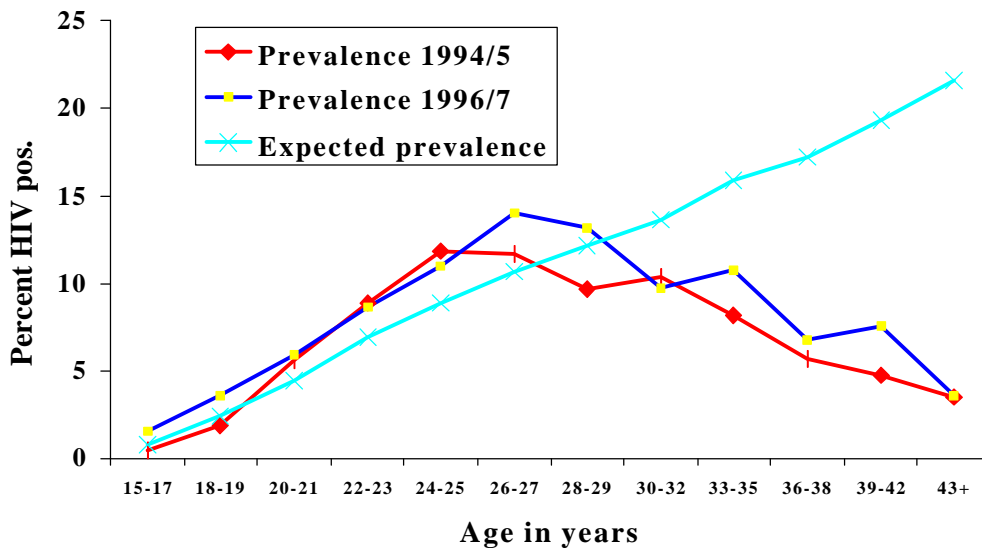
Figure 4b
Observed and 'expected' HIV prevalence
among women, Kisesa 1994-97

The expected HIV prevalence is based on the incidence
rates in the period between the two surveys

Table 1
Indicators of marriage patterns, Kisesa, 1996-97.

	Men		Women	
	N	Percent	N	Percent
Median age at first marriage	1908	23.2 yr	2105	19.0 yr
Current marital status				
Single	2916	48.5	3497	18.0
Married, monogamous	2916	41.5	3497	55.1
Married, polygamous	2916	4.6	3497	15.4
Widowed	2916	0.3	3497	1.9
Divorced/separated	2916	5.2	3497	9.7
Co-residence marital partners				
Married monogamously, not co-residing	1211	0.8	1925	1.6
Married polygamously, not co-residing	133	0.8	537	7.5
Marital history				
Among ever married, at least one broken marriage	1498	44.8	2855	33.9
Among ever married, at least two broken marriages	1498	11.1	2855	5.6
Type of marriage				
Informal marriage	805	25.3	1439	43.0
Bride price not paid in full or not at all	805	41.6	1437	45.1

Age at first marriage was computed from current status and recalled age at first marriage data among respondents under 30 years of age, using a survival analysis.
Polygamous men co-residing with none of the wives.

Table 2
Annual migration by place of residence among men and women 15-59, Kisesa 1994-1998.

	Men		Women	
	N	% moved	N	% moved
Rural villages	2415	9.0	2420	11.2
Peri-trading center	751	10.2	751	12.0
Trading center	1025	13.7	1135	13.9
All	4191	10.3	4306	12.1

Table 3
Selected indicators of sexual behavior in Kisesa, 1996-97

	Men		Women	
	N	Percent	N	Percent
Adolescence				
Median age at first sex among 15-24	1422	17.3 (yr)	1449	15.8 (yr)
Premarital sex among ever married 15-24	1220	73.8	584	65.4
Multiple partners				
Had non-marital non cohabiting partner in last year	2916	59.0	3497	24.9
Two or more partners in last month	2916	8.9	3497	1.7
Three or more partners in last year	2916	28.5	3497	1.9
Extra-marital partner in last year	1344	44.7	2460	4.3
Condoms				
Ever used	2916	18.2	3497	3.7
Uses sometimes with marital partner	1338	7.8	2460	0.9
Uses sometimes with regular partner	784	18.4	602	4.2
Uses always with regular partners	602	2.3	602	1.5
Used sometimes with casual partners	1430	17.4	261	6.1
Uses always with casual partners	1430	8.0	261	6.5